Autonomous Vehicles
EML 4842   Section 4525
Class Periods: M, W, F, 4th period, 10:40 – 11:30 am
Location: FLG 265
Academic Term: Spring 2026

Instructor:
Carl Crane
ccrane@ufl.edu (class correspondence will be through the Canvas website)
352-219-6433
Office Hours: Wed, 8:30-10:15, Zoom meeting ID 873 068 5706 or NEB 140.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website. Zoom meeting office hours will be listed there also.
- TBD

Course Description
Methods and apparatus to automate vehicle navigation. Integration of sensors such as global positioning system (GPS), light detection and ranging (LIDAR), position encoders, and inertial measurement units (IMU). Vehicle propulsion and steering. Python programming language, Linux operating system, robot operating system (ROS2). Autonomous navigation, obstacle avoidance, path planning, dead reckoning, vehicle localization. 3 credits.

Course Pre-Requisites / Co-Requisites
COP 2271 (MATLAB) or COP 2273 (Python) or COP 2274 (C++).

Course Objectives

 At the end of the course, the student will be able to:
- Design a software program and implement in Python language to perform an autonomous vehicle task,
- Design and implement a ROS2 node running on a computer running Linux operating system,
- Design and implement a ROS2 program node to
  - enable the speed and direction control of a vehicle,
  - read the input values from a handheld joystick,
  - teleoperate a robotic vehicle,
  - collect GPS data and record to a ROS2 bag,
  - read the ROS2 bag and draw paths in Google Earth,
  - to collect LIDAR data,
- Design and implement a dead-reckoned vehicle speed, direction control for a vehicle,
- Design and implement an obstacle detection algorithm,
- Design and implement the autonomous navigation of a vehicle based on a desired GPS waypoint path, and
- Design and implement the autonomous navigation of a vehicle based on a desired GPS waypoint path when there are obstacles in the path.

The objectives will be achieved by lectures, readings, videos, homeworks, and students working in groups of three, doing mini-projects.

Materials and Supply Fees
TBD.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	N/A
3. An ability to communicate effectively with a range of audiences	Medium
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	N/A
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

Required Textbooks and Software
- Laptop computer able to run Linux Ubuntu 22.04 operating system.
- Python (open source)
- Robot Operating System 2 (ROS 2) (open source)
- Notes and videos will be provided by the instructor.

Other Recommended Materials
- Python tutorial, https://www.w3schools.com/python/

Course Schedule
Schedule is listed at https://www.ccrane3.com/eml4842/schedule_fall2026.html

Class Supplied Equipment
The course currently has 10 low-cost (~$900 each) vehicles to use. Each vehicle is a small, but high performance, remote controlled vehicle that is equipped with the necessary sensors, computer, and networking controls. Students will be organized in groups of three.

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is expected. Graded class activities will be held on some days. Students are responsible for knowledge of all scheduling and policy announcements made in class.

All homework will be turned in electronically via the class Canvas web site. Assignments that are submitted after the due date and time, but before the assignment closure date and time (usually, but not always, 2 days after the due date) will be deducted 30%. Only the files that are uploaded will be graded. Check your files to make sure they are correct and not corrupted.

Several assignments will be designated as individual assignments. Work submitted for these must be your own and produced exclusively for this course. Other assignments will be designated as group assignments (students will be placed in groups of three). The group members will all contribute to these assignment submissions.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades

Assignment	Percentage of Final Grade
Individual HW sets	25%
Group project 1 - teleoperation	25%
Group project 2 – GPS based navigation	25%
Group project 3 – Lidar based navigation	25%

Grading Policy

Percent	Grade	Grade Points
94 - 100	A	4.00
90 - < 94	A-	3.67
87 - < 90	B+	3.33
84 - < 87	B	3.00
80- < 84	B-	2.67
77 - < 80	C+	2.33
74 - < 77	C	2.00
70 - < 74	C-	1.67
67 - < 70	D+	1.33
64 - < 67	D	1.00
60 - < 64	D-	0.67
0 - < 60	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Class Honesty Penalty

Homework assignments that are designated as individual assignments must be done by the individual student. Any copied assignments will result in a zero for that assignment and a letter grade reduction for the course. For example, if your final grade was to be a B+, it would be reduced to a C+. Assignments designated as group assignments must be completed by only the students in that group.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
- Your academic advisor or Graduate Program Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*:* https://distance.ufl.edu/getting-help/; *https://distance.ufl.edu/state-authorization-status/#student-complaint*.